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TITLE: Enhanced draining and drying cycles
for an automatic
                       dishwasher

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    The preferred embodiment of the present invention
relates to an intelligent
dishwasher 10 as shown in FIG. 1. FIG. 2 shows a block
diagram of the
dishwasher 10 using the present invention. FIG. 2 includes
a wash process
sensor block 12, a microprocessor based controller block
14, and an output
block 16. Generally, the controller 14 receives inputs
from the wash process
sensor block 12, the rinse aid sensor 18, the door sensor
20, the **current**
sensor 22, and the control panel switches 24. The
controller 14 uses these
inputs to control a transistor driver 26 which in turn
drives the various
components and functions of the dishwasher as shown in the
output block 16.

    The dishwasher of the preferred embodiment uses a
turbidity sensor,
conductivity sensor, and wash arm RPM sensor to execute a
cycle selection
process, which determines whether a load is heavily soiled.
 If a heavily
soiled load is sensed, then a double drain function is
incorporated into the
drain cycle to remove the extra soil. FIG. 5 is a time
line showing the
operation of the double drain function. The first drain is
a ninety-seven
second drain, the exact length of which is variable
depending on the motor
current. When the first drain is complete, there is an

eight second pause
followed by a twenty-five second drain to recreate the
siphon effect and remove
the soil and water. The double drain function is used only
during the
pre-washes before the main wash.

In a dishwasher, certain substances in the water may
cause the water to foam
and not wash the dishes as desired. These substances
include for example,
detergents, eggs, powder milks, etc. This reduces the
effectiveness of the
dishwasher. Another problem is present when there is a lot
of material in the
water which may cause the dishwasher pump to "starve" or
not circulate the
water properly. Foaming and starving are detected by
monitoring the line
current. If the line **current** drops while the wash arms
have slowed, then a
foaming or starved pump condition has occurred. Foaming is
detected by a
10%-25% drop in the line **current** combined with a drop in
the wash arm speed.
Starving is detectable by a greater than 25% drop in line
current with a stop
of the wash arm rotation.

The present invention corrects the foaming problem by
draining the water and
foam immediately upon detection of the foam. During a
normal **fill** of the
dishwasher, the motor is turned off. However, if foaming
is detected in the
dishwasher, the motor is turned on during the **fill**
subsequent to the indicated
draining to allow as much water as possible to be added to
the dishwasher since
circulation of the water will add to the amount of water
the dishwasher can
hold. It is desired to add as much water as possible due
to the possibility of
the foam causing the **fill** control mechanism to trip
prematurely. By recovering
from the foaming in this manner, it is attempted to get rid
of as much foam as
possible in the drain cycle portion and add as much water

in the **fill** cycle
portion to create a normal wash action.

Similarly, to correct the starving in the dishwasher,
the system water is
drained immediately upon detection of starving. During the
drain with
approximately 30 seconds remaining, the water is turned on
to attempt to clean
excess food matter out of the pump. The dishwasher is then
filled above the
normal level by adding 10 seconds of filling after the
motor has been turned
on. This again allows as much water to be added to the
dishwasher as possible
since circulation of the water adds to the amount the
dishwasher can hold. It
is desired to add as much water as possible to allow the
pump to work properly
with the amount of food soil present in the dishwasher. By
recovering from
starving in this manner, it is attempted to get rid of as
much of the food soil
as possible in the drain portion, and add as much water in
the **fill** portion to
create a normal wash action.

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